

## 036: VARIATIONS IN ICU MORTALITY RATES AND THE NEED FOR QUALITY IMPROVEMENT IN KOREA

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### Objective:

To evaluate the variations of mortality rates in the intensive care unit (ICU) and to identify patient characteristics and hospital quality factors related to quality in the ICU in Korea.

### Methods:

All the 1,252,355 inpatient episode records of 5,813 hospitals from October 1 to December 31, 2002, in Health Insurance Review Agency's claim database, were analysed. Patients admitted to the neonatal ICU or those younger than 1 year were excluded from the qualifying data. For the corresponding period, the national mortality database in the Korean National Statistical Office was used to identify whether patients discharged from hospitals died. Additionally, we surveyed human resources, equipments, and management of ICU in 366 hospitals and compared them with the performance measures. Standardised mortality ratios (SMRs) were used to adjust for the varying severity of patients admitted to the ICUs.

ICU Performance measures were calculated as follows;

- 1) Excess utilisation ratios on ICU admission, ICU days and ICU intensities (ICU days as a ratio of the total number of inpatient days),
- 2) Excess cost ratios on total cost and daily cost, and
- 3) Excess mortality ratios on excess mortality within 1 day and within 28 days after discharge.

To calculate standardised excess mortality ratios within 1 day, the number of observed deceased patients within 1 day were divided by the sum of expected deceased patients within 1 day, by the strata of Korean Refined Disease-Related Groups (RDRGs). Finally, for reviewing and adjusting various risk factors using administrative data, we selected five main DRGs (open skull surgeries not by injuries, specific cerebrovascular disorders (CVDs), coronary artery bypass grafts (CABGs), acute myocardial infarctions (AMIs) and gastro intestinal (GI) bleeds) and analysed the data using multivariate logistic regression. Age groups, gender, health insurance premium levels (high, medium, low), hospital levels (1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> referral), and other proxy indicators on severity were incorporated in predicting mortality within 28 days after discharge.

### Results:

The coefficients of variance of all excess ratios in the 1<sup>st</sup> referral hospitals were greater than those in the 3<sup>rd</sup> referral hospitals. For the mortality ratio within 28 days, the 3<sup>rd</sup> referral hospitals scored 25.9, the 2<sup>nd</sup> referral hospitals 37.8, and the 1<sup>st</sup> referral hospitals 58.2. High ICU bed ratios were significantly correlated with high excess ICU admission ratios ( $r=0.3973$  /  $p<0.001$ ), especially in the 3<sup>rd</sup> referral hospitals ( $r=0.6268$  /  $p<0.001$ ). But, high excess ICU admission ratios were negatively correlated with excess mortality ratios within 28 days in the 3<sup>rd</sup> referral hospitals ( $n=42$  /  $r= -0.3761$  /  $p=0.0141$ ). Higher numbers of inpatient ICU days were correlated with higher total costs ( $r=0.3660$  /  $p<0.001$ ) and higher mortality ( $r=0.1464$  /  $p=0.0043$ ).

The existence of specialists and their participation in decision-making about ICUs' operations were not significantly correlated with excess mortality ratios within 28 days. However, the number of nurses per bed was negatively correlated with mortality in the 1<sup>st</sup> referral hospitals ( $r= -0.2422$  /  $p=0.0004$ ) and the 2<sup>nd</sup> ( $r= -0.3220$  /  $p=0.0006$ ) referral hospitals. The levels of equipment and management of ICU were also negatively correlated with excess mortality ratios.

In the multivariate logistic analysis of open skull surgery, female ( $p=0.0414$ ), old age ( $p=0.0005$ ), low premium level ( $p=0.0084$ ), higher numbers of ICU days ( $p=0.0432$ ), high ICU intensity ( $p<0.0001$ ), high daily costs ( $p<0.0089$ ), artificial ventilator experience ( $p<0.0001$ ) and log SMRs of sub-diagnosis ( $p=0.0414$ ) were significantly associated with mortality within 28 days. The 1<sup>st</sup> referral hospitals (odds ratio=4.321 /  $p=0.0008$ ) and the 2<sup>nd</sup> referral hospitals (odds ratio=1.714 /  $p=0.0361$ ) showed higher mortality than the 3<sup>rd</sup> referral hospitals. In the specific CVDs, the odds ratios were 2.954 ( $p<0.0001$ ) in the 1<sup>st</sup> referral hospitals and 1.922 ( $p<0.0001$ ) in the 2<sup>nd</sup> referral hospitals. In the CABGs, the odds ratios were 2.0390 ( $p=0.0743$ ) in the 2<sup>nd</sup> referral hospitals. For AMIs, the odds ratios were 2.429 ( $p=0.0238$ ) in the 1<sup>st</sup> referral hospitals and 1.454 ( $p=0.0265$ ) in the 2<sup>nd</sup> referral hospitals. For GI bleeds, the odds ratios were 3.391 ( $p=0.0263$ ) in the 1<sup>st</sup> referral hospitals and 1.786 ( $p=0.0805$ ) in the 2<sup>nd</sup> referral hospitals. Physician resources by hospitals were significantly associated with mortality (within 28days) for the specific CVDs (odds ratio=0.839 /  $p=0.0007$ ) and AMIs (odds ratio=0.844 /  $p=0.0412$ ). The number of nurses per bed was significantly associated with mortality for the specific CVDs (odds ratio=0.552 /  $p=0.0002$ ) and AMIs (odds ratio=0.142 /  $p=0.0002$ ).

**Conclusions:**

The structure, process and the results of the ICU services were highly variable among hospitals, especially in the 1<sup>st</sup> referrals in Korea. Intensive, short and selective utilisation of ICU seems to result in lower mortality and lower costs. Higher mortality rate seems strongly associated with low levels of hospital human resources, low hospital material resources, and also with patient's low health insurance premium level, which is a proxy of socio-economic-status in some health conditions. Considering the significant heterogeneities and adverse outcomes in the 1<sup>st</sup> referral hospitals, there is a gross need for quality improvement and reconstruction of the delivery systems of the ICU in Korea.